Multi-level access to information systems by QR codes for wearable devices

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ABSTRACT

The scientific project "Multi-level access of information systems by QR codes for wearable devices" was carried out within the framework of the scientific grant project of Batumi State University. The idea is practically implemented and discussed in the example of a higher educational institution (university). Various areas of business and state organizations where successful practical implementation of the obtained results is possible are also mentioned.

Based on scientific research, an original software product was created, by means of which only one static QR code placed on different objects (in our research mode, BSU auditorium) allows people with different statuses to access different data, in our case, employees and students. At the same time, the QR code assigned to the room remains unchanged even if the processes in the room change, which excludes frequent changes in the graphic image (QR code) placed on the room(object). The mentioned changes will be implemented only in electronic form on the web page where this information is posted and the user will receive only the updated information. For another example, the method can be used to digitize cities, including tourist facilities, restaurants, cafes, banks, etc., to provide different information about users of different access levels (loyalty programs, etc.) through a single QR code. The field of the practical application of the system can be quite wide in terms of its simplicity and technological practicality. Research methodology is based on modern achievements of computer technology, Internet technologies, and programming tools. These technologies are widely used in the research process and in one of the results of the research - the software product.

KEYWORDS

QR-codes, information systems control, mobile systems, wearable devices, acces to information systems

1 INTRODUCTION

The trends in the development of modern information technologies indicate that more and more providers of information resources are interested in purposefully providing their data (information resources) to users. Targeted delivery of data is primarily related to the growth of the component of information resources administration, and from the point of view of users, this leads to complications and inconvenience of access to resources. All together, it complicates the distribution of services and somewhat hinders their development.

The trend described above was especially well manifested in the era of development of modern mobile (wearable) devices, when a modern person is attached to an information system - a smartphone, but the user interfaces of these devices are still experiencing significant progress. Until now, the unified standard of the mentioned systems is in the process of formation, a good example of which is the appearance of new products in the market of consumer devices, both hardware/software and consumer design. Despite the wide range of hardware and software products, all of these solutions cannot claim to be a data access standard that would unconditionally combine both ease of use and universality, and most importantly, this standard would be compatible with most devices on the market [1], [2].

From our point of view, the above-mentioned problems can be solved by the so-called Data encoding using the QR system. As known, this system allows easy access to various resources and at the same time it can store large enough data in one package. It is already a well-proven mechanism for transferring various types of data [3]. On the other hand, the practicality and popularity of QR-codes makes it attractive to use it in other, as yet unexploited areas, if information security is maintained [4], [5].

Consider the practical value of the idea on the example of a higher educational institution (university). If a QR-code corresponding to

our opinion is placed on any of the university's auditoriums, then only through this one code we can individually provide:

- Students have easy access to the schedule of lectures and related information in this auditorium using mobile devices;

- academic staff - in addition to the lecture schedule, they will have access, for example, to the technical means located in the auditorium;

- University administrative staff will have additional access to the inventory located in the auditorium along with the first and second points.

The QR-code is a static image, and therefore only one code is placed on the audience, while access to various information takes place according to the permission. At the same time, the QR-code assigned to the audience remains unchanged even in case of changes in the processes taking place in the audience, which excludes frequent changes of the graphic image (QR-code) placed on the audience (object). The mentioned changes will be implemented only in electronic form on the web page where this information is posted, and the user will receive only the updated information.

For another example, the method can be used to digitize cities including tourist facilities, restaurants, cafes, banks, etc. To provide different information about users of different access levels (loyalty programs, etc.) by a single QR-code. The field of practical application of the system can be quite wide in terms of its simplicity and technological practicality.

2   REVIEW OF PREVIOUS WORK IN THE FIELD

Due to the practicality of QR-codes, its popularity is obvious [6]. In this direction, a lot of theoretical and practical researches have been conducted and are being conducted to find new possibilities. Our early researches in this direction include several aspects, in particular, the possibilities of controlling a moving model through QR-codes [7] and the second paper is dedicated to the management of information systems through a software product loaded in smartphones [8]. In the first case, QR-codes are read with the smartphone camera, this information is transmitted via Bluetooth to the mobile model, which performs the movement determined by the QR-codes. In the second article, is considered a software product, which is pre-loaded into smartphones, and after reading the corresponding QR-code, information is received on the smartphone according to the status of the owner of the smartphone. We consider the disadvantage of this method to be that it requires download and installation of the software product in the mobile device. In the work presented here, this procedure is simplified using modern Information and Internet technologies.

3   PROPOSED METHODOLOGY

Research methodology is based on modern achievements of computer technologies, Internet technologies, programming tools. Consider specifically:

QR-code generator - creates a code encoded using the BASE64 protocol and, in our case, a symmetric encryption algorithm (the presented solution does not exclude the use of different cryptographic algorithms). In our case, the symbol displacement algorithm is used as the encryption algorithm. The mentioned script generates a QR code with a link to the information system and

Figure 1: Examples of QR-codes: a) - standard coding, b) some modern links in standard coding c) several links that are simultaneously coded BASE64 and encrypted.

also puts information in the code for which access level the link is intended for. The encryption mechanism allows the information system to be protected from attacks and the use of unauthorized software (QR-code scanners), which allows us to guarantee the delivery of data to authorized personnel, and therefore the link that goes to it is only encoded in the QR code and does not appear anywhere else (Figure 1). Based on the above, the external user has no way to see the web address of the system and carry out a certain group of cyber-attacks. Accordingly, the database is connected only to the information system.

In our model task, the QR-code generator script is executed in the programming language JavaScript, since it was easy to integrate this original code into our architecture, which, of course, does not exclude other implementations depending on the requirements of the real information system.

4   ARCHITECTURE OF SYSTEM AND RESULTS

The architecture of the presented system is given in Figure 2.

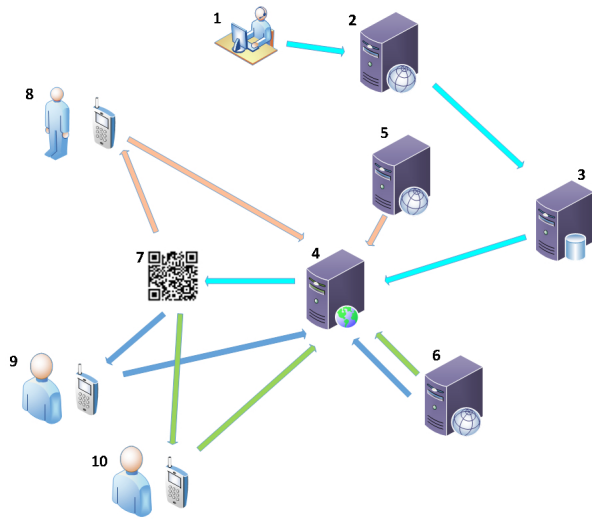The figure shows the following functional components of the system

Figure 2: General architecture of the system (a) and photo of two status persons receiving different information (b).

- Administrative personnel of the information system, which ensures the initial registration of users (registration in different cases can be both manual and automatic or with the so-called 2-level verification) and user status management;
- The administrative interface of the information system, which provides both the management of users and the management of the content of the information system;
- The common database of the information system, which contains records that ensure the unity of the system and is used for managing the system (users and content), and based on its records, QR codes necessary for accessing the content are generated and distributed.;
- The main server that provides the content of the information system (in our case, the web server);
- Content management system serving unauthorized users;
- Content management system that serves authorized users (the case in which users with different access statuses are served by different content management systems is not excluded);
- Generated fixed and printed (distributed) QR code that provides access to information resources;
- Unauthorized user with own device;
- Authorized user with own device;
- Authorized user with other status (access rights).

The solution to the given task consists of several functional modules (see Figure 3, which form a single structure, but nevertheless each module represents a completed task and can be used independently under certain conditions.

At the beginning of use, the main page will open on the user's device, where he is given the opportunity to authenticate. Upon successful authentication, the user will have access to existing data according to his status. Authorization is a one-time process and re-authorization is required if the user's device or status has changed. If the user enters the wrong data, he will get to a screen with a brief instruction on how to use the system and a re-authorization offer.
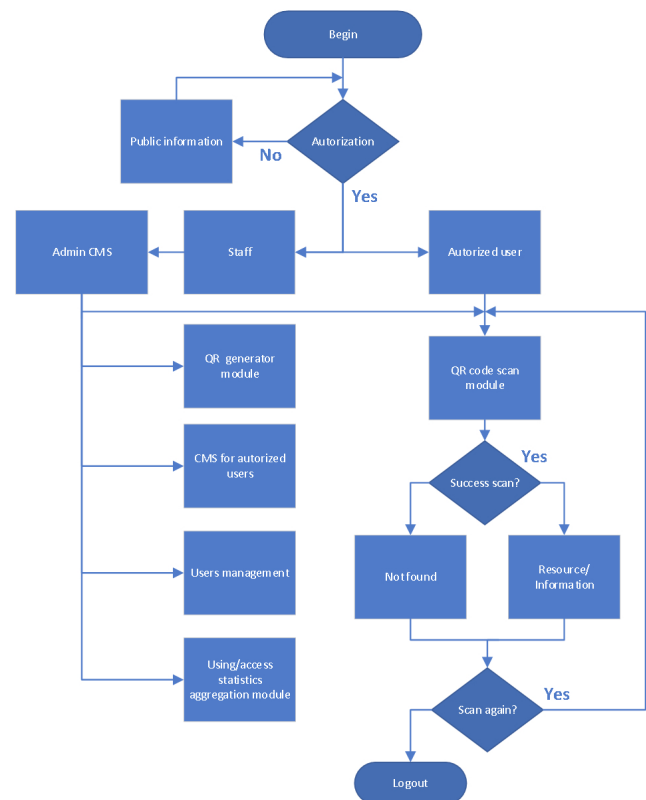

Figure 3: Structural scheme of functional modules of the task.

After successful authentication, the user gets to the main page of the user interface of the system - on the QR-code scanner. We have developed the user interface of the QR-code scanning function,

which provides scanning of the QR-code and interpretation of the received data according to the user's role. It should be noted that in order to start using the photo/video device of the user's device by the website, it is necessary to obtain the appropriate rights (permission), which quite often causes some misunderstanding on the part of unprepared users, which causes problems with access to the incorrect response option (the user will still not be able to scan the QR- to scan the code). Accordingly, it became necessary to create the mentioned interface.

A customer management system is provided, a user interface for creating a new customer with a short introduction. It is also possible to edit the user, change his status, block or delete him.

The system also provides for the collection of statistical characteristics of various statuses of user activity. Statistical processing of user activity data is very practical for this type of information systems, which allows us to make an additional contribution to improving the management of the organization.

Such QR-codes can be placed both on objects and on various material resources, which, as mentioned above, will allow us to access data related to these material resources based on user statuses.

In order to register various material resources, a special user interface was created, which allowed us to test the realization of the idea. Of course, the functional load of such interfaces completely depends on the functional cycles of prospective information systems.

5 CONCLUSIONS

The software products and instructions obtained within the project can be successfully used by various organizations (universities, schools, municipalities, banks and others) to provide different information to interested persons using QR-codes according to their interests and personal status.

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